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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/010,696	12/05/2001	Visvamohan Yegnashankaran	072219-0261614 (P05088)	7056

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EXAMINER
VU, QUANG D

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 07/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/010,696	YEGNASHANKARAN ET AL.	
	Examiner	Art Unit	
	Quang D Vu	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 April 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-6,8-10,26,33-36 and 45-55* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *2-5 and 8-10* is/are allowed.

6)☒ Claim(s) *6,26,33-36 and 45-55* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 26, 33-36 and 45-55 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification never discloses the first dielectric material lying in a first region that lies horizontally entirely between the second and third metal lines. The specification (fig. 12b) discloses the first dielectric material lies in a portion of a first region that lies horizontally between the second and third metal lines. The specification also never discloses the second dielectric material formed over the first region as claimed in claim 26.

The specification never discloses the second dielectric material is formed in a second region that lies horizontally entirely between the fourth metal line and the fifth metal line as claimed in claim 34. The specification (fig. 12b) discloses the second dielectric that lies between the second metal line and the third metal line.

The specification never discloses the second dielectric material is formed on and over the second region as claimed in claim 36. The specification (fig. 12b) discloses the second dielectric material is formed between the second metal line and the third metal line in the first region.

The specification never discloses the second plurality of metal lines having second and third surfaces, and including fourth, fifth, and sixth metal lines as claimed in claim 45. The specification also never discloses a second dielectric material formed between the first and second metal lines and the fourth and fifth metals, the second dielectric material extending from a point on the first horizontal plane between the first and second metal lines to a point on the second horizontal plane between the fourth and fifth metal lines as claimed in claim 45. Furthermore, the specification never discloses a third dielectric material formed between the second and third metal lines and the fifth and sixth metal lines, the third dielectric material extending from a point on the first horizontal plane between the second and third metal lines to a point on the second horizontal plane between the fifth and sixth metal lines as claimed in claim 45.

The specification never discloses a fourth dielectric material that contacts the third surfaces of the fourth, fifth, and sixth metal lines as claimed in claim 46.

The specification never discloses the third dielectric material extends from the point on the second horizontal plane between the fifth and sixth metal lines to a point on the third horizontal plane between the seventh and eighth metal lines as claimed in claim 49.

The specification never discloses a second dielectric material that contacts the second surfaces of the fourth and fifth metal lines and the third surfaces of the sixth, seventh, and eighty metal lines as claimed in claim 50. The specification also never discloses a third dielectric material formed within a region that lies in the first horizontal plane between the first and second metal lines as claimed in claim 50. Additionally, the specification never discloses a fourth dielectric material formed between the second and third metal lines, and the fourth and fifth

metal lines, the fourth dielectric material extending from a point on the first horizontal plane between the second and third metal lines to a point on the second horizontal plane between the fourth and fifth metal lines, the fourth dielectric material and the third dielectric material having a different dielectric constant as claimed in claim 50. Furthermore, the specification never discloses a fifth dielectric material formed within a region that lies in the third horizontal plane between the sixth and seventh metal lines, the fifth dielectric material and the fourth dielectric material having a different dielectric constant as claimed in claim 50.

The specification never discloses a sixth dielectric material formed within a region that lies in the third horizontal plane between the seventh and eighth metal lines, the sixth dielectric material and the fourth dielectric material having a different dielectric constant as claimed in claim 51.

The specification never discloses the sixth dielectric material and the fifth dielectric material are equivalent as claimed in claim 52.

The specification never discloses the third dielectric material is also formed within a region that lies in the first horizontal plane between the second and third metal lines as claimed in claim 54.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6,262,446 to Koo et al.

Regarding claim 6, Koo et al. (figure 4) teach a multilevel metal interconnect formed on a semiconductor substrate, the semiconductor substrate having a plurality of active areas, the multilevel metal interconnect comprising:

a plurality of layers of insulation material (12, 30, 34), the plurality of layers of insulation material including a first layer of insulation material (12) and a top layer of insulation material (34), the first layer of insulation material (12) being formed on the semiconductor substrate (10);

a corresponding plurality of patterned metal layers (16a-e; 32a-d; 36a-d) formed on the layers of insulation material (12, 30, 34) so that each patterned metal layer is formed on a corresponding layer of insulation material, the plurality of patterned metal layers including a first patterned metal layer (16a-e) and a top patterned metal layer (36a-d), the first patterned metal layer (16a-e) being formed on the first layer of insulation material (12);

a plurality of contacts (14a-e) formed through the first layer of insulation material (12) to make electrical connections with the active areas and the first patterned metal layer (16a-e);

a plurality of via formed through the plurality of layers of insulation material (30, 34) other than the first layer of insulation material (12), the vias making electrical connections with adjacent patterned metal layers.

a capacitive structure (20) formed between adjacent metal lines of a patterned metal layer (16e, 16g), the capacitive structure (20) being formed from a dielectric material (17b). It is inherent that the dielectric material being different from one of the layers of insulation material.

It would have been obvious for the dielectric material including a plurality of layers of dielectric material because it depends on the capacitive structure between adjacent metal lines.

Allowable Subject Matter

5. Claims 2-5 and 8-10 are allowed.

6. The following is a statement of reasons for the indication of allowable subject matter: The most closely related art, US Patent No. 6,262,446 to Koo et al. and US Patent No. 6,222,269 to Usami. Koo et al. and Usami do not anticipate or render the claimed invention such as a multilevel metal interconnect formed on a semiconductor substrate, the semiconductor substrate having a plurality of active areas, the multilevel metal interconnect comprising: a plurality of trenches formed in the layers of insulation material, each trench adjoining metal lines of the top patterned metal layer, a trench extending from the top metal layer between metal lines of the top metal layer through the top insulation layer and between metal lines of a metal layer lying below the top metal layer, each trench having a bottom surface, the trenches not including conductive material. The second major difference between the claimed invention and the prior art is the multilevel metal interconnect comprising: a plurality of trenches formed in the layers of insulation material, a first trench being filled with air and a second trench being filled with the dielectric material.

Response to Arguments

Applicant's arguments with respect to claims 2-6, 8-10, 26 and 33-36 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Quang D Vu whose telephone number is 703-305-3826. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

qv
June 30, 2003

Steven Loke
Primary Examiner
Steven Loke